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DECLARATION FOR TRANSLATION

As a below named translator, I hereby declare that:

My residence and citizenship are as stated below next to my name.

I hereby certify that I am conversant with both the English and Japanese language and the enclosed herewith is a true and accurate English translation of the Japanese patent document JP Hei 4-161340.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

JAE-HO MOON *et al.*

Serial No.: 09/782,029

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Art Unit: 2853

For: INK-JET PRINthead

TRANSMITTAL OF ENGLISH TRANSLATION

Commissioner for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith is the English translation of Japanese Patent No. Hei 4-161340, for the above-referenced application.

Respectfully submitted,

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INK JET PRINTER HEAD

Patent Number: JP4-161340

Publication date: 1992-06-04

Inventor(s): TUTOMU SATO

Applicant(s): TOKYO ELECTRONIC CO. LTD

Abstract

PURPOSE: To make ink drops fly straight in order to improve printing quality by a method wherein the structure of a printer head is made up of a discharge opening formed at the end of a chamber opposite to the supply opening opened toward the center of the bottom of a chamber enclosed completely by wall surfaces and connected to an ink tank and of the heating elements arranged around the supply opening of the bottom of the chamber.

CONSTITUTION: Since heating elements 10 are arranged around a supply opening 7 in the bottom surface 6 of a chamber 5 and face toward a discharge opening 8 and since the air bubbles 12 formed by the heating action of the heating element 14 become increased toward the discharge opening 8, the efficiency of the flying energy of ink drops is improved. Moreover, since the chamber 5 is completely enclosed by wall surface 4 and the discharge open 8 and the supply opening 7 are oppositely positioned at both ends of the chamber 5, the pressure of the ink is exerted on the center of the discharge opening 8. Therefore, the ink drops can be flown straight. Since the supply opening 7 is obstructed by the air bubble film 13 formed and increased by the heating action of the heating unit 10, the reverse flow of the ink 11 toward supply opening 7 is hindered and changes in the ink pressure at the discharge opening 8 can be prevented more effectively.

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WHAT IS CLAIMED IS;

1. An apparatus of ink jet printer head, said apparatus comprising of;
 - the chamber enclosed by wall surface;
 - the supply opening connected to the ink tank at the center of the bottom of said chamber;
 - the discharge opening formed at the end of said chamber opposite to the supply opening; and
 - the heating unit arranged around said supply opening on the said bottom of said chamber.
2. An apparatus according to claim 1, wherein said heating unit positioned oppositely at the center of both side of said camber.
3. An apparatus according to claim 1, wherein said heating unit with one or more openings on the middle positioned on the bottom of said chamber.

Detailed description of Preferred Embodiments:

[Background of the invention] This invention is about the ink jet printer head.

[Background Art] The inkjet printer head is a well-known method wherein as shown in FIG. 6(a), the substrate 52 with heating unit 51 is positioned inside surface of orifice 50, ink 54 is provided from the supply side 53 of the orifice 50, as shown in FIG. 6(b), bubble 55a is produced by boiling said ink 54 on the heating unit 51, said bubble 55a become increased as bubble film 55 as shown in FIG.6(c)(d)(e), and the ink drop fly toward the record paper from discharge opening 56 of the orifice 50 as shown in FIG. 6 (f)(g).

Moreover, the inkjet printer is also a well-known method wherein as shown in FIG. 7, the heating unit 61 is positioned inside of orifice 60 on where the supply opening 59 is formed, with three sides of barrier 58, heating unit 61 boils the ink which is provided from the supply opening 59 into the orifice 60, and constantly produced into the supply opening 59 at rectangular angles simultaneously the ink is flown onto the heating unit oppositely from the discharge opening.

[The problem to solve by this invention] The ink jet printer head as shown in FIG. 6 wherein the pressure of output of ink drop 57 decrease because the pressure of the ink 54 caused by boiling affects the supply side 53 of the orifice 57. In that respect, an apparatus in FIG. 7 shows a small improvement because the discharge opening cross the supply opening at right angles, but the pressure of the ink caused by boiling affect the supply opening 59. The flying direction of ink tends

to be curved since the direction of the pressure on the supply opening 59 meet the direction of flying ink from the supply opening at a right angles. Therefore, the quality of printing is affected.

[The method to solve the problem] The invention indicates an apparatus according to claim 1, is comprising of;

a chamber surrounded with walls;
an opened supply opening connected to an ink tank on the center of the bottom of the chamber;
a discharge opening formed on the edge of said chamber oppositely to the supply opening; and
the heating units positioned around said supply opening on said bottom of said chamber.

The invention in claim 2 is the system as set forth in claim 1, wherein the heating units are positioned at least symmetry on both sides of centered chamber.

The invention in claim 3 is the system as set forth in claim 1, wherein the heating units with one or more vents on the center are positioned the bottom of chamber.

[Function] The invention in claim 1, wherein because the heating units are arranged around a supply opening on the bottom of the chamber and face toward a discharge opening, the air bubble formed by the heating action of the heating unit become increased toward the discharge opening. Therefore, the energy efficiency of the flying ink drop is improved. Moreover, since the chamber

is completely enclosed by the wall, and the discharge opening and the supply opening are positioned oppositely at both ends of the chamber, the pressure of ink exerted on the center of discharge opening.

The invention in claim 2 and 3, wherein the supply opening is obstructed by the air bubble film formed and increased by the heating generating of the heating unit. Therefore, the reverse flow of ink toward supply opening is hindered and changes in the ink pressure at the discharge opening can be prevented more effectively.

[Example of practice] The invention in claims 1 and 3 is explained based on FIGs. 1 through 4 as follows; the substrate 2 and surface 3 which cover one surface of ink tank 1 are positioned symmetrically with certain space. More than one chambers 5 covered around with all surfaces of walls 4 are positioned between these substrates 2 and surfaces 3. The supply opening 7 connected through said ink tank 1 is formed on the bottom 6 (which is one surface of substrate 2) of these chamber 5, and the bigger discharge opening 8 than said supply opening 7 is formed on the said surface 3. The centers of chamber 5, the supply opening 7, and the discharge opening 8 coincide. Moreover, the heating unit 10 with a vent 9 facing toward said supply opening 7.

On such a construction, the ink 11 inside of chamber 5 is heated into boiling after the voltage is added into the heating unit 10, and as shown in FIG. 4(a) the air bubble 13 was formed. These bubbles become increased into air film 13 as FIG. 4(b) shows, the supply opening 7 is obstructed by the air bubble film 13, moreover, as the air bubble film 13 become increased, the ink 11 is flown from the discharge opening 7 as shown in FIG. 4(c). Afterwards, the air bubble film 13 inside of the chamber 5 becomes constricted rapidly and the ink 11 of ink tank 1 is produced into chamber 5 from

the supply opening 7.

Since the air bubble 12 formed by the heating action of heating unit 10 become increased toward the discharge opening 8 because the heating unit 10 positioned around the supply opening 7 on the bottom 6 of the chamber 5 faces against the discharge opening 8, the flying energy of the ink drop increase efficiently. Moreover, the pressure of the ink is exerted on the center of the discharge opening 8, for the chamber enclosed by walls 4 and the discharge opening 8 and the supply opening 7 are positioned oppositely at both edges of the chamber 5. Therefore, ink drop can fly straight. The reverse flow of ink 11 toward supply opening 7 is hindered and changes in the ink pressure at the discharge opening can be prevented more effectively because the supply opening 7 is obstructed by the air bubble film 13 formed and increased by the heating generating of the heating unit 10.

The invention in claim 2 is explained based on FIG. 5 as follows; the same explanation as set forth in the example of practice will be omitted by using the same symbol. The invention in claim 2 is an apparatus wherein the heating unit 14 is positioned on both sides on the center of chamber 5 symmetrically. Therefore, as set forth in the example of practice, the reverse flow of ink 11 toward supply opening 7 is hindered and changes in the ink pressure at the discharge opening 8 can be prevented more effectively because the supply opening 7 is obstructed by the air bubble film 13 formed and increased by the heating generating of the heating unit 10.

[The result of the invention] The invention in claim 1 as above, is comprising of;

the chamber surrounded around with walls,

the supply opening enclosed on the center of the bottom of said chamber and connected to

the ink tank ,

the discharge opening formed at end of said chamber facing toward the supply opening, and the heating unit positioned around said supply opening on the said bottom of the said chamber, so the energy efficiency of the flying ink drop is improved since the air bubble formed by the heating action of heating unit 10 become increased toward the discharge opening 8. Moreover, the pressure of the ink is exerted since the chamber is completely enclosed by the wall, and the discharge opening and the supply opening are oppositely positioned at both ends of the chamber. Therefore, the ink drop can be flown straight, and the quality of printing is improved.

The invention of claim 2 as above in claim 1, since the chamber is positioned at least symmetrically at both side on the center of the chamber, the supply opening is obstructed by the air bubble film formed and increased by the heating generating of the heating unit. Therefore, the reverse flow of ink toward supply opening is hindered and changes in the ink pressure at the discharge opening can be prevented more effectively.

The invention of claim 3 as above in claim 3, since the heating unit with one or more than one vents on the center is positioned on the bottom of the chamber, the supply opening is obstructed by the air bubble film formed and increased by the heating generating of the heating unit, therefore the reverse flow of ink toward supply opening is hindered and changes in the ink pressure at the discharge opening can be prevented more effectively.

4. Simple explanation of figures

Fig.1 and 4 show an example of practicing the invention of claim 1 and 3. The Fig.1 is a horizontal surface, Fig.2 is a front elevation showing inside on chamber without the surface, Fig.3

is a skew diagram showing inside of chamber, Fig.4 is a vertical cross section showing the flying process of ink drop, Fig. 5 is a front elevation showing the inside of chamber without the surface related with the invention in claim 2, Fig .6 is an explanation to indicate the former ink jet printer head and the flying process of ink drop, and Fig. 7 is cross section showing the former ink jet printer head.

1...ink tank, 4...wall surface, 5...chamber, 6...the bottom of chamber, 7...supply opening, 8...discharge opening, 9...vents, 10...heating unit